Philippines KALAHI-CIDSS Impact Evaluation Third Round Data Collection Report Addendum: Additional Analysis of Impacts on Palay Productivity

Innovations for Poverty Action

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Abstract

The Final Report for the KALAHI-CIDDS Impact Evaluation found that project-funded road improvements led to declines in yields among rice growers in the Philippines. In this Addendum, we explore the potential causes and consequences of this result. We find that smallholder farmers shifted out of rice cultivation in villages where roads had been improved. Because these smallholders typically have higher yields, the average yield among remaining rice farmers declined. We find that these farmers may have partially shifted into other crops, although our ability to detect these changes is limited. We do not find evidence of shifts into other economic activities, although our sample size constrains our ability to statistically detect some potential responses. Overall, households in the villages with roads improvements experience lower consumption per capita than in comparison villages, although they also have improved access to key services such as schools, health clinics, and markets.

1 Introduction

In June 2018, Innovations for Poverty Action (IPA) completed its Final Report for the Philippines KALAHI-CIDSS (KC) Impact Evaluation. The report detailed findings from the randomized control trial in which 198 Filipino municipalities were randomly assigned into a treatment group in which the KC program would be rolled out and a comparison group in which program roll-out was delayed.[1]. The evaluation was funded by the Millennium Challenge Corporation (MCC), which also funded a major portion of the KC program roll-out being evaluated.

Among the findings of interest in the report was a notable and unexpected result that villages (*barangays*) in which the KC provided funding for local roads upgrading experienced drops in the productivity of palay[2] rice farming (relative to the comparison villages with which they were matched). The purpose of the present Addendum is to explore the

[1]For more details on this report, please see https://www.mcc.gov/resources/doc/summary-measuring-results-of-the-philippines-community-driven-development-project-kalahi-cidss

[2]*Palay* is the commonly used term for unmilled, or "paddy", rice in the Philippines.

underlying dynamics behind this result, unpacking the source of the changes to the extent possible.

It is important to note several other related findings from the Final Report. First, KC investments improved access to key local services, and road improvements in particular reduced transport costs for agricultural, fishery, and livestock products. The reductions in average agricultural yields was driven by reductions in mean yields for palay (hence the present assessment). Other socioeconomic impacts included improvements from education and water services investments. No impacts on longer-term outcomes, such as household consumption, assets, or labor, were detected from KC investments as a whole.

2 Design

We conduct most of our analysis using the survey data collected from 5,940 households in 198 municipalities across 26 provinces of the Phillipines. In 2011, the 198 municipalities were matched and into pairs based on demographics and province, and then randomly assigned into a treatment and comparison group. Within each municipality, we randomly sampled one village in which we collected data over multiple rounds. Each village in the treatment group was eligible to participate in the KC activities, including requesting funding for subprojects (SPs) for local public goods improvements. There was a wide array of SP types funded; among the treatment group, 12 villages had received funding for roads improvements and had completed these improvements by the time of our third round data collection. Our analysis here compares these 12 villages to the 12 comparison villages in the paired municipalities. As discussed in Section 5.5 of the Final Report, this subset of treatment and comparison villages were quite similar on observable characteristics, largely because differences in SP type preferences were largely across provinces (within a given province, many villages preferred the same types of SPs). Moreover, while some KC activities had begun in the comparison villages by the time of our data collection (due to the national roll-out of the KC-NCCDP project), none of these comparison villages had actually completed any KC-NCDDP-funded road improvements (or any other SPs) by this time. Thus, our comparisons can be considered valid causal estimates of impact. Finally, the treated and comparison villages were initially similar on a variety of observed characteristics (as intended by the randomized control design), and accounting for initial yields and other variables as control variables in our estimation did not substantively change the results.

Our primary unit of analysis is the household, and palay production is aggregated across all plantings in the preceding year (in some areas, there are up to three palay plantings per year). We estimate the treatment impacts using ordinary least squares estimation while controlling for matched pair fixed effects and clustering standard errors by municipality.

3 Findings

We begin by unpacking the impacts on yields among palay growers along several of the underlying dimensions. Our results are presented in Table 1. In column (1), we replicate our prior finding showing 0.32 kg/m^2 lower yield in villages where roads SPs were completed

relative to their matched, randomly assigned comparison villages. Because yields are only estimable for farmers who actually grow palay, one channel through which these lower yields could materialize is in a changing extent and composition of palay farming in the treated group. Indeed, in column (2), we find that the share of sampled households who actually grow palay is significantly lower in the treatment group than in the comparison group. In fact, 51% of households in the comparison group grew palay in the preceding 12 months, while only 24% of households in the treated group did so.[3] The resulting average total area under palay for all respondent households in our sample is 850 m^2 lower in the treatment group than in the comparison group (column (3) of Table 1) and total production of palay is 121 kg lower (column (4)).

Table 1: Impacts on Palay Production

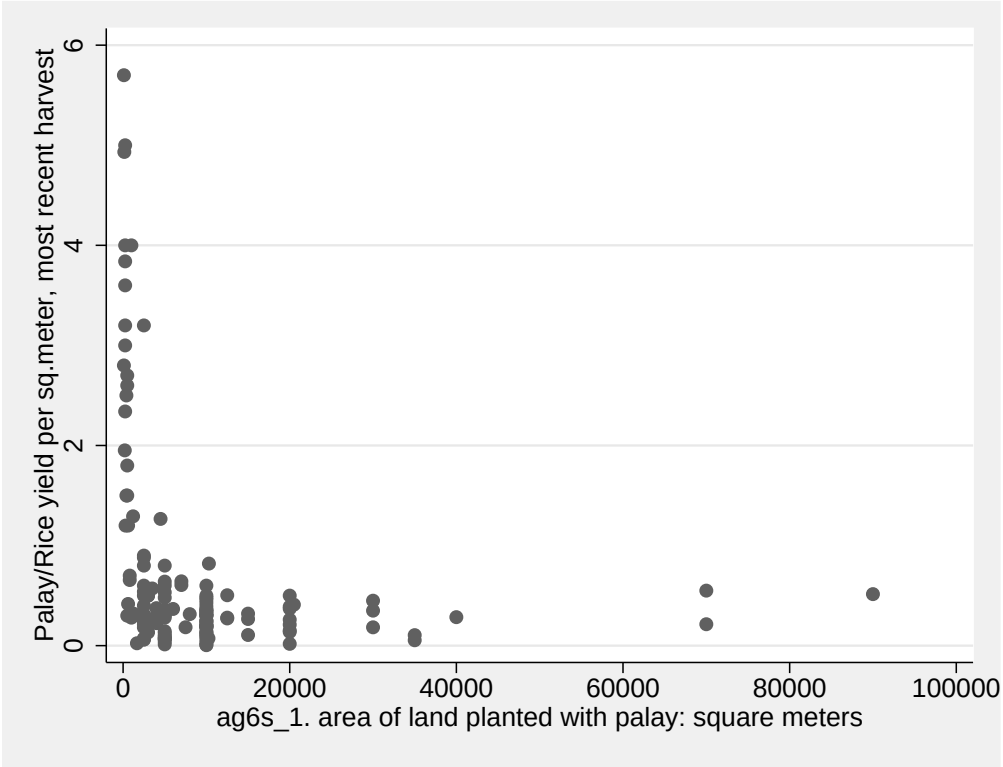
Dependent variable	(1) Yield	(2) Grow Palay	(3) Area	(4) Total prod.	(5) Area	(6) Total prod.
Roads	-0.317*	-0.275**	-850.2	-121.9	2530.6	640.8
SP completed	(0.119)	(0.0946)	(860.7)	(333.1)	(1805.1)	(1015.1)
Sample	Palay Growers	All HHs	All HHs	All HHs	Palay Growers	Palay Growers

Standard error clustered municipality in parentheses. All regressions include province fixed effects. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The exit from palay farming appears to be particularly concentrated among smaller scale farmers. As a result, the average area under palay cultivation and palay production among those who do farm palay is higher in the treatment group than in the comparison group, as shown in columns (5) and (6) of Table 1. Palay farming in the Philippines exhibits the inverse yield-area relationship commonly found in many developing country contexts, reflecting higher yields among smallholders than larger scale farms. This phenomenon is clearly visible in Figure 1 below, which shows the correlation of rice yields on the vertical axis and palay area planted on the horizontal axis, exhibiting a clear inverse relationship. Taken together, these results explain why average palay yields decline when smaller scale farmers stop cultivating palay.

[3]Issues with the baseline data collection resulted in unreliable estimates of the share of palay farming households at baseline, making comparisons over time infeasible. However, the randomized assignment to treatment allows us to interpret the endlined difference in palay farming household shares across treatment and comparison groups as the causal impact of KC treatment.

Figure 1: Yield-Area curve



We next explore some of the potential causes and consequences of these phenomena. One possibility is that the improved roads reduce the costs to households of buying and consuming rice grown elsewhere, thereby reducing the effective demand for locally grown palay rice and potentially pushing farming households out of palay cultivation. While our survey data do not distinguish the source of rice (or other foods), we can estimate the average price of palay obtained by farmers in the village. In column (1) of Table 2, we estimate the impact on these average prices, showing a small point estimate that is positive but not statistically distinguishable from zero (for comparison, the sample mean price is 15 PHP/kg, so the point estimate is equivalent to $< 1\%$ change. In column (2), we again estimate the impact on whether households grow palay, this time controlling for the average palay price in the village. If prices are the channel through which the road improvements lead to palay cultivation exit, we would expect to see the coefficient on road improvements is smaller in absolute value than in Table 1 column (2). In fact, the coefficient is larger in absolute value. Taken together, there is no evidence that the road improvements lowered palay prices or that prices played a role in the lower share of palay farmers in these villages.

We also consider whether natural disasters or other external factors may have played a role in shifting the production of palay. The most common natural shocks reported in the village-level questionnaire were floods, typhoons, and droughts. We therefore test whether these could have differentially affected the treatment group, and whether they serve as the channel through which impacts on palay cultivation take place. In column (3) of Table 2,

our outcome measure is an indicator of whether the village experienced a flood. We find a 17% *lower* incidence of floods among treatment villages. Could this imbalance in flood experience account for the road projects' impacts on palay production? In columns (4) and (5), we return to our estimates of impacts on whether the household grows palay (col 5) and yield (col 6), this time controlling for whether the village experienced a flood. We see no substantial differences in the effects of the roads improvements on whether households grow palay and the mean yields, relative to the main effects shown in Table 1. We repeat this analysis for typhoons in columns (6)-(8) and droughts in columns (9) - (11). While we find that treatment villages were 25% more likely to experience a typhoon (col 6), this experience appears unrelated to the impacts of the roads improvements on palay production (cols 7-8). There is no difference in drought experiences across the treatment and comparison groups (col 9), and thus no change in the impacts of roads improvements on palay production while contorlling for drought experience (col 11). Taken together, these assessments show little evidence that natural disasters could have been the causes behind the road improvements' impacts on palay cultivation.

Table 2: Potential causes

Dep. var.	(1) Average price	(2) Grow Palay	(3) Flood	(4) Grow Palay	(5) Yield	(6) Typhoon	(7) Grow Palay	(8) Yield	(9) Drought	(10) Grow Palay	(11) Yield
Roads SP completed	0.0547	-0.300**	-0.167	-0.191**	-0.327*	0.250	-0.280**	-0.242	1.18e-16	-0.229**	-0.326**
	(1.232)	(0.0777)	(0.116)	(0.0664)	(0.118)	(0.152)	(0.0805)	(0.123)	(0.121)	(0.0723)	(0.0893)
AveragePrice		-0.0247									
		(0.0191)									
Flood				0.309***	-0.178*						
				(0.0660)	(0.0762)						
Typhoon							0.0771	-0.221			
							(0.101)	(0.195)			
Drought										-0.205*	0.256**
										(0.0833)	(0.0766)
Sample	Palay growers	All HHs	All HHs	All HHs	Palay growers	All HHs	All HHs	Palay growers	All HHs	All HHs	Palay growers

Standard error clustered by municipality in parentheses. All regressions include pair fixed effects. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

We next explore whether farmers exited palay cultivation and turned to various other economic activities. We first assess whether they increased the area under cultivation for crops other than palay, effectively substituting other (potentially higher-valued) crops. In column (1) of Table 3, we find some increase in the area devoted to other crops, but this effect is not statistically distinguishable from zero. For comparison purposes, the estimate of increase in area devoted to other crops (317 m^2) is approximately 37% of the reduction in area devoted to palay (850 m^2). In the data, we find that these results arise because of differences in total area among larger farmers rather than among smallholders. We see the largest increases in area under coconut cultivation, but these differences are also not statistically distinguishable from zero. Nonetheless, we cannot rule out the possibility that smallholder farmers shifted out of palay and into some other agricultural activities.

We also assess whether palay farmers exited farming and increased their other labor force activities. We thus estimate effects on related outcomes, including (1) the share of household adults who are in the labor force, (2) the average employment status (full-, part-, or self-employment) among adults in the household, and (3) total monthly income among household adults. These results are shown in columns (4)-(6) of Table 2. For none of these outcomes are the results distinguishable from zero (our standard errors are small enough to reject relatively small changes in employment of approximately 5 percentage points). We do

find a large coefficient on monthly income (-850 PHP, equal to approximately 20% of mean income), but given our sample size, we cannot distinguish this effect from zero. We thus find little evidence that the improved roads funded by KC allowed smallholder households to move out of palay and into other parts of the labor force.

Finally, we consider whether households experienced broader shifts in transportation usage as a result of the road improvements. As previously noted, we estimated reductions in travel time and costs to key services, as well as reductions in agricultural transport costs, as a result of KC road improvement SPs. We supplement this by examining households' total expenditures on transportation in column (5). We find a small reduction of 5 PHP per month (31 PHP in the preceding 6 months), but it is not statistically distinguishable from zero. This is not surprising, as the lower unit cost of transport may have led to increases in the quantity used, thereby dampening the effects on the total expenditures. However, in column (6), we also observe a large reduction in consumption per adult equivalent (-1,380 PHP, equal to 34% of the sample mean) due to the road SP completion. This reduction suggests that, although the road SPs improved transport and access to key services, they may have worsened many conditions for the average village resident in the two years after their completion. In separate regressions, we confirm that the same result obtains when we control for baseline consumption, exposure to natural disasters and other controls. We also find large and significant reductions in consumption across the baseline distribution (i.e. similar declines for both initially poorer and better off households). We also confirm that there was no statistical effect on household asset holdings, indicating that the reduction in consumption was not due to concomitant increases in household savings behvaior.

Table 3: Shifting to other economic activities?

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Area other crops	In Labor Force	Employ. Status	HH Month. Inc.	Transport Expend.	Consumption
Road	317.2	0.0293	0.0337	-849.1	-31.98	-1380.0*
SP completed	(596.6)	(0.0228)	(0.0254)	(555.4)	(91.76)	(573.2)
Sample	All HHs	All HHs	All HHs	All HHs	All HHs	All HHs

Standard error clustered municipality in parentheses. All regressions include matched pair fixed effects. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4 Conclusions

We explore the changes in palay production and related economic activities taking place in the 12 sample villages where roads improvements were completed with KC funding, as well as 12 comparison villages. In these comparison villages, half of households cultivate palay, but only a quarter do so in the treated villages. The difference is primarily in the exit of small-scale palay farmers; since these farmers typically have higher yields, the mean yields among the remaining palay farmers are lower in the treated villages than in the comparison villages.

Although we test a variety of competing causes, there is no clear evidence attributing this phenomenon to one specific source. Our sample of villages is quite small, meaning that in some cases we cannot distinguish what may be substantial effects from zero. This

is particularly challenging because other household changes may be quite dispersed across multiple dimensions or activities, making these multiple smaller effects harder to detect.

Finally, although we observe exit from palay farming as a result of the roads improvements and overall reductions in household consumption, we cannot definitely conclude that household welfare is worse off because of the road improvements. The cost to transport goods and services to and from markets are significantly lower in treated villages, and the travel times and costs to access key services such as schools, health clinics, and government towns are also lower. Thus, it is possible that these households may enjoy compensatory gains in welfare in the longer term. Nonetheless, it appears that policymakers should pay particular attention to changes in agricultural production that may result from rural road investments.